PLAY METER

NEWS UPDATE

Volume 7, Number 6 April 1, 1981

Manufacturers organize

CHICAGO—A trade association was formed February 10 by a number of manufacturers of coin-operated amusement devices.

The charter members of this association, which is named the Amusement Device Manufacturers Association (ADMA), are Stern Electronics, Inc.; Atari Inc.; Williams Electronics, Inc.; Rock-Ola Manufacuring Corp.; Gremlin Industries, Inc.; Exidy, Inc.; D. Gottlieb & Co.; Game Plan, Inc.; Cinematronics, Inc.; Taito America Corp.; Centuri, Inc.; and U.S. Billiards, Inc.

The association's board of directors consists of Joseph Robbins, Atari; Michael Stroll, Williams Electronics; Gary Stern, Stern Electronics; Donald Rockola, Rock-Ola Manufacturing; Dwayne Blough, Gremlin Industries; H.R. Kauffman, Exidy; and Robert Bloom, Gottlieb.

At the February 10 meeting, the board of directors of the newly-formed ADMA elected as its officers Joseph Robbins, president; Michael Stroll, vice president; and Robert Bloom, treasurer.

According to an association spokesman, the board of directors will hire a full-time executive secretary and retain a general counsel, all this happening "within a very fast time frame."

The purposes of the association include "diligently representing the manufacturers of coin-operated amusement devices in the areas of legislation, governmental and industrial regulations, and public relations."

"The association will fully cooperate with all corresponding organizations in other parts of the industry," an association statement read, "including those of the operators and the distributors."

All companies which manufacture coin-operated amusement devices in the United States are invited to join the association by contacting any of the above manufacturers for details. According to the ADMA spokesman, the association plans to raise the necessary funds for its operations through membership dues. Membership will apparently be restricted to amusement machine manufacturers only.

"I think it's a well-needed thing for the manufacturers to work in all these various areas," the association spokesman added.

The spokesman would not elaborate, but the association's most immediate and pressing issues appear to be on two fronts: (1) dissociating coin-op amusement machines from gambling and pseudo-gambling machines and (2)

continued on page 2

Ed Shaffer dies at 67

COLUMBUS, Ohio — Ed Shaffer, president of Shaffer Distributing, died suddenly February 3 at age 67. A company spokesman said Shaffer had apparently been in good health and had a good medical history.

Shaffer had been in his family's coin operation and distributorship for nearly 50 years and had bought full ownership in 1954 from his parents.

Ed Shaffer is survived by his wife, Dorothy; mother, Mrs. Ada Shaffer; a daughter, Mrs. Jeanne Farmer, all of Columbus; and sons, Dr. Edward E. Shaffer of Denver, and Steven Shaffer, vice president of marketing for the distributorship.

Having woked on the Shaffer Music Co. coin machine route during high school and college years, Ed Shaffer began in the business full-time in 1932. From that period of counter top pingame and jukebox operating, the Shaffers' coin business grew into a multi-state operation from its Columbus base. During World War II, the firm be came a rebuilding operation during the period of scarce equipment. After the war, the firm went into solely distributing. Seeburg was then its line, and later it also handled pool tables.

Today having an additional office in Macedonia, Ohio, Shaffer Distributing's lines include Rowe, Bally, Gottlieb, Stern, Midway, Valley, UBI, and other table and vending lines. Ed Shaffer has stated that the company's vending sales in recent years have been as strong as the music and games areas.

In the development of the family's coin business, Ed Shaffer has been recognized by industry people as adaptive to changes in the industry and aggressive in his work. He reflected the drive and foresight of his father, Estel "Pop" Shaffer, who had recognized coin-operated counter games as revenue producers during the Great Depression and sold his pharmacy in Columbus to become a full-time coin operator.

At the time of Ed Shaffer's death, Shaffer Distributing was active in all the major cities of Ohio as well as West Virginia and Kentucky and had become one of the largest U.S. coin machine distributorships.

Funeral services for Ed Shaffer were held Friday, February 6, at Shoedinger Funeral Chapel, Columbus.

Estel Shaffer, founder of the firm and a coin man since 1929, died in November at the age of 87. ■

NEWS UPDATE

Volume 7, Number 6

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protecting the proprietary rights of manufacturers regarding new games.

On the first point, numerous manufacturers—including most of the charter members of ADMA—have served notice to the operators' national association, AMOA, that they will not exhibit at the 1982 AMOA Show if that show is held, as scheduled, in Las Vegas (*see PLAY METER, January 15,pages 28-31*).

These manufacturers are balking at the idea of an industry trade show in Las Vegas because, they contend, it would suggest connections between gambling interests and coin-operated amusement machines. And this, they say, would create a negative and possibly hostile governmental predisposition against their products.

Several ADMA members in the recent past have even called for an industry stand against so-called "gray area" video games (such as blackjack and video poker games). They claim these machines are actually camouflaged gambling devices which are exploiting local and state laws designed to regulate pure amusement machines.

To date, the operators' national association has not taken a position on this issue, although several state associations of operators have joined in the protest against the proliferation of these devices.

On the second point, following numerous instances of manufacturer copying popular video amusement games, both in the United States and abroad, many American manufacturers—including a number of those listed as charter members of ADMA—have begun to take a more aggressive approach toward protecting their proprietary rights.

At recent industry trade shows in London and Frankfurt, manufacturing firms which are now members of ADMA successfully gained injunctions against the showing of games which they alleged were copies of games to which they held the proprietary rights. •

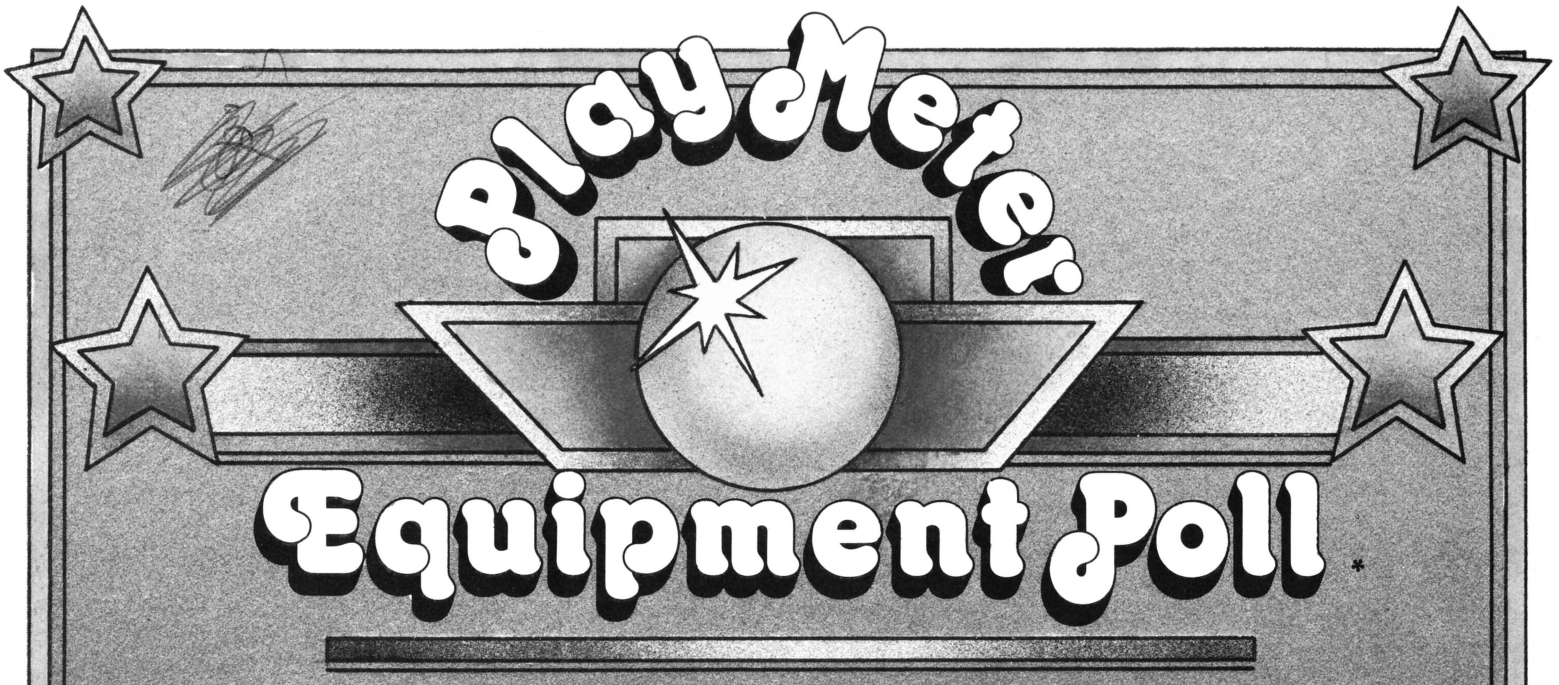
NAMA is ready at Phoenix

CHICAGO—More than 100 exhibitors have reserved space for the 1981 NAMA Western Convention/Exhibit of Vending and Foodservice Management, which will be held in Phoenix for the first time, April 3-5. "We expect to top the record number of 144 exhibitors of 1980," said Jack Reilley, NAMA director of sales, adding that 14 first-time exhibitors have already signed up.

This will mark the first time since its beginning in 1960 that the NAMA Western Convention has been held outside California. "The beautiful exhibit hall in downtown Phoenix, the proximity of first-class hotels, and the chance to visit Arizona's sights and entertainment areas should attract a sizeable attendance this year," Reilley commented.

Official convention hotels are the Adams and the Hyatt Regency. NAMA will handle reservations through its own Housing Bureau at 7 S. Dearborn St., Chicago 60603. ‡

Exidy President Pete Kauffman gets an award from the Northern California Van Council's leader, Robert Bland, left (an Exidy employee), for Exidy's donation of a Targ game—used in a recent youth charity fundraiser staged by the Van Council.



Top Videos

THIS MONTH		LAST MONTH
1	ASTEROIDS/Atari	1
2	PAC MAN/Midway	5
3	BATTLEZONE/Atari	4
4	GALAXIAN/Midway	2
5	MISSILE COMMAND/Atari	3
6	BERZERK/Stern	10
7	SPACE INVADERS/Midway	7
8	STAR CASTLE/Cinematronics	6
9	DEFENDER/Williams	—
10	MOON CRESTA/Nichibutsu & Gremlin	8

Top Pins

THIS MONTH		LAST MONTH
1	FIREPOWER/Williams	1
2	FLIGHT 2000/Stern	3
3	BLACK KNIGHT/Williams	5
4	XENON/Bally	8
5	BLACKOUT/Williams	2
6	GORGAR/Williams	6
7	SPACE INVADERS/Bally	4
8	FLASH GORDON/Bally	—
9	KISS/Bally	—
10	SCORPION/Williams	12
11	SUPERMAN/Atari	—
12	ALIEN POKER/Williams	7
13	PLAYBOY/Bally	—
14	FLASH/Williams	9
15	PARAGON/Bally	—
16	MATA HARI/Bally	—
17	GENIE/Gottlieb	—
18	STELLAR WARS/Williams	20
19	SILVERBALL MANIA/Bally	15
20	LASER BALL/Williams	16

**Equipment Poll will be a continuing feature of PLAY METER NEWS EDITION.*

If you would like to join readers currently participating in the survey, simply fill the coupon below and mail to: *Play Meter Equipment Poll, P.O. Box 24170, New Orleans, LA 70184.*

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By
Pat
Matthews

The hitmakers return

As a quick follow up to the recent picture story in this column, March 15 issue—the Cold is still hot! Vance and the band have begun to branch out a bit more and plan to tackle the states of the Southeast, now that success has been attained in Texas and Louisiana. By the end of 1981, just about everybody will have had "Cold Fever" at one time or another.

People Are Strange—The Doors—Elektra/E-47097-A

No, there isn't any reason to adjust your eyes. You're seeing quite correctly. Obviously in an attempt to cash in on a renaissance of this group's popularity, Elektra Records has re-released this treasure from the back of your mind. A mild chart success the first time out, this very indentifiable Jim Morrison composition about the limits of paranoia could garner the new audiences being predicted and make the over-25 crowd feel "Strange" again. A crowd pleaser—*7 out of 10* or better.

Guitar Man—Elvis Presley—RCA/JH-12158

While we're into post-mortem music, The King is back! Well, sort of. Felton Jarvis, a producer of some reknown, has put this little up-tempo Jerry (Reed) Hubbard composition together to satisfy the remaining millions of faithful fans. It's identifiable Reed and Elvis—bringing to mind "When You're Hot You're Hot" and "Burning Love." Out of all the issues after El's death, this one makes one think that he's still around, or *wish* he would be. Incredibly, this will probably enjoy only Country success, while *I* believe the time is right for some crossover activity. At any rate, *8 out of 10* country.

Outside—Ambrosia—Full Moon/FMS49654

No, they haven't changed labels, at least at last report. They've done some tunes for a movie entitled "Inside Moves" and this is from the soundtrack. It's written by group member and lead singer David Pack and is a composite drawing of everything you've heard from this group in the past two years. It sounds, too, like Ambrosia's first attempt at making movie music will be a successful one. Good song. Characteristic Ambrosia with plenty of character. Nice sax and guitar work fills this next link in a chain of record successes from a group which certainly paid its dues before going public, so to speak. Expect *9 out of 10* or more.

Hello Again—Neil Diamond—Capitol/P-4960

Here's another artist who went "astray" from his usual record label to do some movie music. Of course, this story is a bit more familiar since this is the second single from *The Jazz Singer* soundtrack, and the lp is getting more than its share of airplay. The album is a definite sales success and all those women who don't care if Neil Diamond can act, yet have seen the movie more than once, will scoop this beautiful ballad (again!) right up. Especially if they can get their hands on the nice packaging with the bearded Neil with baby and wife (from the movie) in mid embrace. Hitting *10 out of 10* probably by the time you read this.

All American Girls—Sister Sledge-Cotillion/46007

It certainly has been a while since these siblings have had a hit. Well, they're back with one sound that made them famous and it's not written or produced by the "men from Chic." The honor this time goes to another master of the danceable funk, Narada Michael Walden. An obvious sequel to "We Are Family," this one is timely in a sense and could be just as much a rallying point as the first Sledge chart success. Crossover pours from it; *10 out of 10* on highest chart.

Our Paths May Never Cross—Merle Haggard—MCA/51048

"Hag" has got himself another barroom classic. From the opening blues piano ripplings, you know what you're in for: 3 minutes plus of music to nurse a beer by. **Leonard** is the flip side of this country hit record, and it's Haggard's real life tribute to singer/songwriter Tommy Collins (whose real name is Leonard Sipes). The song is catchy and the lyrics tell the tale of a man who obviously inspired Merle Haggard more than once in his illustrious career; *10 out of 10* Country.

Rapture—Blondie—Chrysalis/CHS2485

And now for the killer! Deborah Harry and company have outdone themselves...AGAIN! You know you've reached a certain point in a musical career when you can do songs uncharacteristic of your established sound and still turn the masses on. The only group that comes to my mind in this regard is the Beatles. And now, Blondie. What seems like a parody of "Rap" records is really more. It's a combination of jazz, disco, funk, rock, and absurdity. All of these elements when swallowed as one pill takes you on a high which is hard to come down from. Chances are, you may not want to come down, but you may want to *get* down. Deborah, do it to us forever; *10 out of 10* or higher. It may be the record of the year!

AOE Seminars/March 12-14: A menu for the industry

By RAY E. TILLEY

Building on the success of the first-ever offering of 1980, Amusement Operators Expo '81 has been stocked with many improvements suggested by the enthusiastic attendees of the first show, said Ralph C. Lally II, publisher and editor of PLAY METER, the AOE sponsor.

First, the AOE returns to New Orleans and displays at the Hyatt Regency Hotel's opulent facilities near the Louisiana Superdome complex. For three days, March 12-14, AOE will be the scene of coin-op business information sharing, new product introductions, and sales of the equipment. Ninety-eight percent of 1980 attendees have indicated they will return for AOE '81, and many exhibitors and operators will be on hand for the first time in the industry's growing springtime show.

"The seminar program has been expanded with a wider range of educational sessions, covering business management, technical repair, and everything in between," said Lally. Seminars will run from 9:00 to 10:30, mornings, with the exhibit hall open from 10:30a.m.—4:30 p.m. each day and afternoon seminars scheduled for 4:40—6:30 p.m. daily.

A registration form has been provided to each subscriber to PLAY METER. Further information is available by contacting the Amusement Operators Expo's organizers, Conference Management Corp., Stamford, Connecticut 06901; phone 203/356-1900.

The kickoff program will be a special, free "Early Bird" general session on Wednesday, March 11, before the show's official opening, to begin at 6 p.m.and run to 7:30 p.m.

"Challenges and Responses: It's Time for Industry Action" is the theme of the Early Bird meeting which features noted industry lawyer Rufus King, Stern Electronics President Gary Stern, and Charles S. Paul, vice president and general counsel of Atari, Inc., as leaders of the informal discussion of problems the industry faces, going into the new decade. A get-acquainted cocktail session at 5 p.m. precedes the meeting. While the seminar is free of charge, registrants were asked to indicate on their registration forms whether attendance was planned.

Another free session comes on Thursday, March 12, at 6 p.m., called "The Quick Fix," with Millie McCarthy, president of the New York State Coin Machine Association, and a panel of industry personalities in a frank discussion of coping with negative images of the coin-op trade. Attendees should also note their desire to attend this session on their registration forms.

Fees for other educational seminars/workshops listed below are $15 each for advance registration (before February 13) and $25 for later registration. Attendance in as many as six sessions can be scheduled.

Here are the courses in the AOE Seminars:

Thursday Sessions: 9-10:30 a.m.
Seminar 101
Arcade Design and Construction: A Practical Approach. The first of a

Operators' ears were keen in the popular seminars of the 1980 AOE. Amusement Operators Expo/'81 provides a packed schedule of coin-op business info sessions, and times do not conflict with exhibit hours.

two-part session, *201* being on Thursday afternoon, 4:30, this is designed to acquaint the owner/operator with the details of effective design and construction of an arcade. Seminar leader will be Steven J. Bodenstein, vice president/development for Six Flags Amusement Centers, Inc. An attendee must register for both parts of the program.

Seminar 102:

Field Service: Keeping Simple Problems Simple. For the operator who does not require a full-time technician, here is a seminar to equip him with the details of a basic maintenance program that he can handle alone. Seminar leader is Doc Lofaso, independent game technician of Resada, California, who will discuss the planning necessary in a sound field service program.

Seminar 103

Advertising for the Coin-Op Business. Carol Kantor, president of Business Builders marketing agency, will delve into key points to be considered in making advertising decisions.

Seminar 104

Signature Analysis: The Future of Troubleshooting. In the first of a four-part program, Jim Sneed will cover the means of isolating digital logic faults at the component level. The tracking of signals and the conversion of lengthy bit streams into four-digit hexidecimal "signatures" will be highlighted during this technical series. An individual must register for all four parts of this program, continuing in sessions *204, 304,* and *404.*

Seminar 105

Location Cost Analysis. Tying course material together with sessions on depreciation (*305*) and business profitability (*604*), Charles C. Ross has expanded his popular seminars of 1980's AOE and will show how to use depreciation tools in analysis of the location. A method will be offered in place of "seat of the pants" thinking, said Ross, for "showing how to divide costs to each location and determining whether a location should be kept or whether you should pull out."

Thursday Sessions: 4:30-6 p.m.

Seminar 201

Arcade Design and Construction: A Practical Approach/Part 2. Steven Bodenstein presents the second in a two-part session on the details that go into effective design and construction of an arcade. Registration is required for *101* also.

Seminar 202

New Equipment Purchasing for the 1980s. Fred Skor, president of World Wide Distributors, examines the various factors that lead to a wise purchasing decision in the face of rising costs.

Seminar 203

Shopping Centers and Arcade Leasing. Jon Daugherty of LeMans Development Co. will moderate a panel of national arcade company executives and shopping center developers in discussing the shopping center, one of the prime factors in the growth of the amusement machine industry. Factors in finding and selecting locations within a shopping center, negotiating the lease, and analyzing the costs will be covered.

Seminar 204

Signature Analysis: The Future of Troubleshooting/Part 2: Jim Sneed continues the four-part series designed for the technician. Registration is required also for sessions *104, 304,* and *404* .

Seminar 205

The Pinball Tournament: A Practical Approach. Douglas E. Grear, president of the American Pinball Association, will present an in-depth discussion of the steps in setting up the tournament. The seminar will deal with increased location revenue through forming pinball leagues.

Friday Sessions: 9-10:30 a.m.

Seminar 301:

Equipment Marketing in Arcades. Basic guidelines of value in terms of in-house marketing will be discussed by Steven Bodenstein, vice president/development with Six Flags Amusement Centers. Location, visibility, price, and incentives will be covered in this session.

Seminar 302

Training Personnel: An Investment that Pays Immediate Dividends. Art Seglin, instructor in Hudson County (New Jersey) Area Vocational Technical School, will detail the development of an effective training program, including discussions on what is available for training personnel and how to keep technicians up-to-date on technical changes.

Seminar 303

Internal Cash Controls and the Absentee Owner. How can you deal with cash losses when you, as owner, cannot be on the premises all the time? Jon Daugherty will lead discussion on the various systems available within the industry which are designed to alleviate losses. Also, the use of polygraph, coin-count metering systems, and collection procedures will be explored.

Seminar 304

Signature Analysis: The Future of Troubleshooting. Third in a four-part series which begins Thursday morning (session *104*); in-depth material for the technician.

Seminar 305

Depreciation Facts and Fallacies. Charles C. Ross will examine depreciation and its impact on coin-op business profitability. Some misconceptions of which depreciation methods are best for an operator will be covered at length. The attendee will be given an understanding of how depreciation should be seen from the accounting standpoint. Materials will be handed out; a notepad and pens will be needed.

Friday Sessions:4:30-6 p.m.

Seminar 401

Creative Marketing and General Promotion in the Coin-Op Business. Carol J. Kantor will give an overview of creative techniques to meet the marketing objectives of the amusement games industry. Toward each owner/operator developing a specific marketing and promotion plan to meet the needs of his location, Kantor will present guides to setting up and promoting special events, getting publicity, and evaluating the results.

Seminar 402

Keep the Ball Rolling and the Aliens Moving. Art Seglin will instruct attendees in troubleshooting techniques through the use of a limited amount of test equipment. Emphasizing "up time," the differences between in-shop and on-location servicing will be seen in light of making better mintenance decisions.

Seminar 403

The Profitable Distributorship. Chuck Arnold, general manager of the Northeast Region for Rowe International, in this session *for distributors only* will examine gross profits as they relate to games, music, and vending.

Seminar 404

Signature Analysis: Final part. The technique that is to the computer era as the Simpson 260 VOM was to the electro-mechanical era is detailed by

Topics: *Technical Troubleshooting — Business Records — Computers — Depreciation — Leagues & Tournaments — Investment — Tokens —*

Jim Sneed. See sessions *104, 204,* and *304.*

Seminar 405

Making the Street Arcade Profitable for the Operator. Rich Babich, president of Automated Amusements/Denver, looks into the difficulties many operators have had in establishing a profitable street arcade. Discussion will be given to potential locations, equipment needs, promotion, and the overall stability of any given operation.

Saturday Sessions: 9-10:30 a.m.

Seminar 501

Business Forms and Record Keeping. A panel of successful operators will explain how they have organized their routes to boost their record-keeping abilities. Moderator will be Michael A. Babich, CPA, of Denver. Efficient use of forms will be demonstrated along with the use and evaluation of the information that is gathered.

Seminar 502

Electronics—How Times Have Changed. If you feel lost in the ins and outs of solid state, a seminar for you is held by Jay Hannah, service manager for Automated Amusements/Denver. Designed for the owner/operator rather than the technician, baffled by the technology jumble of today. Material covered will include hiring technicians, reliable suppliers, how to save money on board repair, and "what to avoid"—for example, so-called discount items. An overview of the terms and uses of electronics will also be presented in order to acquaint the operator with what his technician is talking about.

Seminar 503

Starting and Managing the Arcade The arcade operation has different aspects from other new ventures that are also managed on sound business practices. Steve Isaacson, general manager of S.L. London Music Co., will examine topics such as determining locations, construction, licensing, purchasing, management, and game mix and traffic flow.

Seminar 504:

How You Can Benefit from a Pool League. A pool league has been recognized as a viable means of producing revenue and enhancing public relations. Richard Hawkins, president of D&R Star, will discuss the specific benefits to the operator and the location, as well as the best means to take advantage of the pool league promotion.

Seminar 505

Negotiating Commissions with Locations. In terms of inflationary costs, operators will be instructed by Stephen Goot in how to explain their situation to locations in a plain and logical manner. The president of Total Vending Services, Inc. will also discuss establishing weekly minimums and assessing service charges.

Saturday Sessions: 4:30-6 p.m.

Seminar 601

The Hit Syndrome. How many hits does an operator buy, past the point of their economic justification to him? How many sales does a distributor lose on good game pieces that are less than runaway hit attractions? Ray Hibarger of Hanson Distributing will take on the topic of "the hit syndrome" and define it from both the impact on route operations and distributor sales. He will offer an outline for coping with the hit syndrome and discuss "Is it good or bad?"

Seminar 602

Practical Solid State Amusement Repair. Randy Fromm of San Diego Arcade School will stress the efficient use of the digital multimeter instead of a lot of expensive equipment to diagnose problems in all types of coin-op amusement games. Workshop highlights will include testing diodes and transistors, troubleshooting power supplies, testing integrated circuits, and troubleshooting audio circuits.

Seminar 603

Token Operations: An Alternative for Profit. As an item for promotion, cash control, and security, the token's use in operating will be examined by Eric Ivary, Sega Centers' director of operations. Details will be shared on "how a private money system can work to generate increased revenues."

Seminar 604

Return on Investment and Business Profitability. The age-old question of when to rotate a piece of equipment will be discussed in depth, as well as when to sell equipment. Charles Ross, a successful operator and management consultant, has developed a system he will explain for how to make these vital decisions for greater profit in an amusement games operation. The course material has been developed to tie into Ross's seminar sessions *105* and *305.*

Seminar 605

Computer-Assisted Management Systems for the Mid-size Operator. A computer management system will be discussed that will allow tracking of when equipment needs to be moved, where it has been, when it has been collected, and what is its location—for little or no more additional expense than an operation's current bookkeeping costs. Moderator Rich Babich will lead discussion of entry forms, hardware needed, and software and output information during this session. The seminar will be geared for the 200-to-1,000 piece operation.

Seminar 606

Arcades—An Equipment Strategy for the 80s. Opposing points of view will be presented by Steve Isaacson and Jon Daugherty, as to an overall strategy for the arcade of the 1980s. Questions dealing with equipment location, high play pricing versus diminishing returns, and methods of disposing of used equipment will be discussed at length.

All sessions will be held in the Hyatt Regency Hotel, located at 500 Poydras Plaza, New Orleans. Registrants for seminars will automatically receive Exhibit Hall admission badges with their tickets.

The Amusement Operators Expo will provide a full schedule for the attendee. But the city has much to offer for the industry persons who also want to enjoy local color and flavor during those days, or in the evenings.

"Lagniappe" is the local phrase, a Cajun term meaning "a little something extra," like 14 oysters for the price of a dozen, or a free play. And lagniappe is what is offered in sights, sounds, and tastes—a riot of pleasures for the visitor, all within walking distance or a short taxi ride from the AOE Show site.

Not the least of the bonuses is the food. New Orleans enjoys its food, and its restaurateurs love to serve fine dishes from excellent seafood to the hearty Creole menus.

Then there are the sights and activities. Here you can bring your family, your special flame, or your Cousin Kate and find enjoyment for an afternoon—or as long as you please.

Guides to the city and its sights are included in the March 1981 issue of PLAY METER, and the April issue which previews the AOE. •

DIGITAL CIRCUIT DESIGN COURSE: LESSON TWO

Semiconductor Diodes

Editor's Note: The material below is a serialization of the Kurz Kasch correspondence course for electronics, designed specifically for the coin-operated amusement industry. This course is copyrighted and owned by Kurz Kasch of Dayton, Ohio and its reprinting is being sponsored jointly by Kurz Kasch and Play Meter magazine. This material is authorized for publication exclusively by Play Meter magazine.

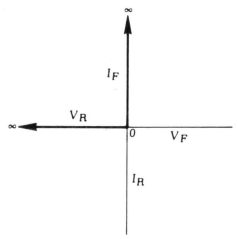


Fig. 2-1. The operational characteristics of an ideal diode. Note that V_F = 0, I_F extends to infinity, I_R = 0 and V_R extends to infinity.

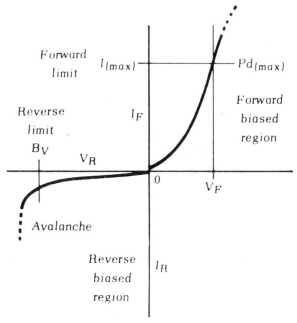


Fig. 2-2. The operational characteristics of a practical diode. Compare V_F, I_F, I_R and V_R with those of fig. 2-1. Also, note the limits $Pd_{(max)}$ and B_V.

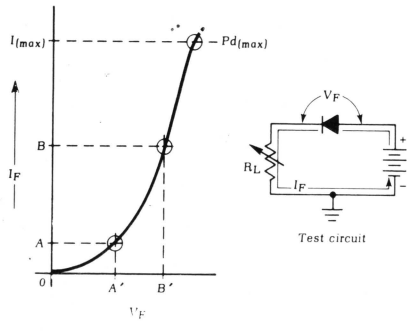


Fig. 2-3. The forward biased characteristics of a typical diode. V_F increases as I_F increases to the operational limit $Pd_{(max)}$.

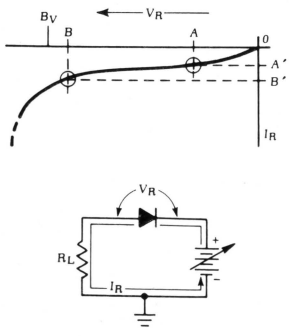


Fig. 2-4. The reverse biased characteristics of a diode. I_R increases as V_R increased to the limit B_V.

This lesson is all about diodes. Emphasis is placed on the terms associated with diodes and what they mean. Particular care has been given to keying the lesson to manufacturers' data sheets.

The Ideal Diode:

To achieve an understanding of semiconductor diode characterisics, it is best to first discuss an ideal diode. This imaginary rectifier (which exists only in our minds) has ideal characteristics —in other words, it is perfect. As shown in *figure 2-1,* when forward biased it is capable of passing an infinite amount of current [IF] and regardless of the forward current, it would drop zero volts [VF]. The zero voltage drop indicates that the resistance of the device, when forward biased, is zero ohms. Therefore, the power dissipated by the diode, regardless of the current through it, is zero watts. Using the power formula for proof:

$$P = I^2 \times R$$

(if R = 0 then P = 0

When this ideal diode is reverse biased it would be capable of not breaking down regardless of the reverse voltage [VR] across it. Also, there would be no leakage current [IR]. The lack of IR indicates that the resistance of this imaginary diode is infinite. Using Ohm's Law for proof:

$$R = E/I$$

(If I = 0 then R is without limit, or infinite value)

Based on the above, it can be stated that an ideal diode would switch from a zero ohm state to an infinite resistance state when the source voltage is reversed.

The Practical Diode

If the diode described in the above paragraphs existed, the circuit designer would be able to pick, at random, any diode and install it into his circuit. His choice of diodes would require no thought since they would all have infinite capability and would, therefore, be the same. In reality, no semiconductor diode is perferct. These implications are topics of the following paragraphs.

Figure 2-2 shows the typical behavior of a real diode when forward and reverse biased. It should be noted that with the real diode there are definite operating limits, bothg in the forward and reverse biased states. Also, the forward and reverse resistances of the real device are far from those ofthe ideal diode: note IR and VF.

We will now focus our attention to the forward biased behavior of the diode curve and *figure 2-3.* The test circuit shown in *figure 2-3* illustrates the meaning of VF and IF,while the load resistance is varied to change the current IF. As RL is varied from a maximum resistance to a lower value, the current drawn through the diode increases, say, from point A to point B. VF also changes from point A′ to point B′. Notice that the *current* [IF] *through the diode determines the voltage* [VF] *dropped across the diodes.*

The current through the diode can be increased by decreasing RL until the product of the current through the diode and the voltage across the diode equal the maximum power [$Pd_{[max]}$] that the device is capable of dissipating.

$$I_F \times V_F \leq Pd_{(max)}$$

Once the dissipation by the diode exceeds the manufacturers' stated limit, the diode will then operate on the principle of *thermal runaway.* Diodes operated beyond the stated $Pd_{[max]}$ will, under normal circumstances, be destroyed.

When the real diode is reverse biased, as in the circuit of *figure 2-4,* a small current will flow. This current is typically in the order of microamperes. As battery voltage in the test circuit is adjusted, for

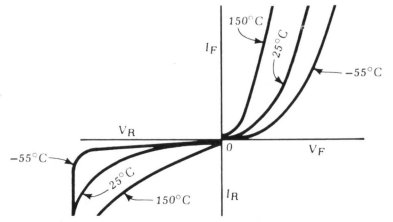


Fig. 2-5. A comparison of the variations in operational characteristics due to changes in T_A.

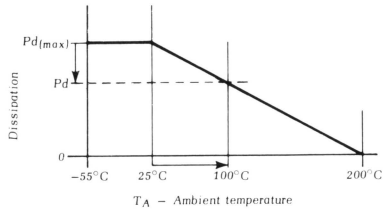


Fig. 2-6. A typical thermal derating curve as given on manufactures data sheets. An increase in T_A results in a decrease in Pd.

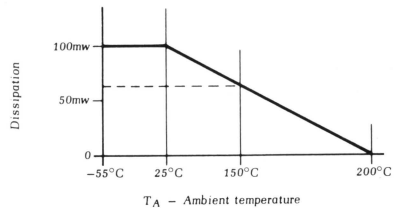


Fig. 2-7. The student should estimate $Pd_{(max)}$ for operation at 150° C.

example from point A to point B, the reverse current [IR] increases from point A′ to point B′. It should be observed that in the reverse biased state the reverse voltage [VR] *determines the current through the diode* [IR], as oppoed to IF controlling VF in forward biased state. The battery voltage can be increased to the limit BV (breakdown voltage). BV is stated by the manufacturer and when exceeded, the diode will enter the *avalanche region.* Once a diode is operated in the avalanche region it will be destroyed.

Thermal Effects:

The resistance of the semiconductor material lies somewhere between that of an insulator and that of a conductor. The resistance of the semiconductor material is determined by the availability of current carriers for a given volume. In conductors (copper wire, etc.), current flow is the result of free electrons reacting to applied EMF (voltage). Current flow through semiconductors results from electrons and holes, which are the absence of electrons from the internal crystal structures. The amount of electrons and holes in the semiconductor is the result of a careful blend of impurities to the basic material; also, the resistance of the block is inversely proportionate to the number of carriers (electrons and holes).

As the ambient temperature [TA] is increased, more carriers become available and the resistance of the device lowers. The increase in carriers is the result of some of the electrons absorbing energy from heat. Inversely, should the ambient temperature be lowered, electrons would give off energy and the result would be fewer available carriers. The effects of change in ambient temperature are shown in *figure 2-5.* Note that when the ambient temperature decreases, making fewer carriers available, VF increases.

Should the ambient temperature be higher than the manufacturers' stated limit, the diode will go into the condition of thermal runaway, as was the case with internal dissipation [$Pd_{[max]}$]. Most manufacturers provide a derating curve or multiplier on the data sheets which accounts for both internal dissipation and ambient temperature. *Figure 2-6* is a typical derating curve showing that when the ambient temperature is increased, $Pd_{[max]}$ decreases. Quite often, however, the manufacturer will state derating information in the form of a decrease in power dissipation per degree centigrade increase in ambient temperature above 25° centigrade. For example, 150 milliwatts per degree centigrade would be shown as [150 mw/° C.]. When stated in this form, the manufacturer is using a shorthand method of describing *figure 2-6.* To use the stated information, the designer need only to subtract 25° C from the ambient temperature and multiply the difference by the power decrease and then subtract the answer from the stated $Pd_{[max]}$ at 25° C.

EXAMPLE 1:

If the curve in *figure 2-7* is to be used to derate a particular diode, determine the maximum dissipation at 150° C.

EXAMPLE 2:

A diode is rated at 250mw at 25° C and must be derated 2mw/° C. We wish to operate this diode at 75° C. What is the maximum allowable dissipation at75° C?

First subtract to find the difference in operating temperatures:

75° C - 25° C = 50° C

Multiply the difference by 2mw.

2mw x 50 = 100 mw

Subtract the above from 250 mw.

250mw - 100 mw × 150mw

ANSWERS TO EXAMPLES—

1. *The diode can dissipate up to 65mv at 150° C.*

2. *The diode may dissipate a maximum of 150mv at 75° C.*

End of lesson two.

PROGRAMMED TEST, LESSON TWO

Instructions: *The purpose of this test is to guide you step-by-step through actual circuit design problems. Also, the tests in the Digital Circuit Design Course may provide you with additional design technique. Most important, these tests will provide you with a gauge to establish your degree of understanding of the material covered in the lesson text. The test is programmed: start at block 1 and follow the numbered instruction associated with your answer.*

1

The voltage drop across a diode when it is forward biased is

a. VF — *GO TO BLOCK 20*

b. BV — *GO TO BLOCK 15*

2 YOU ARE INCORRECT!

Refer to the text and return to BLOCK 20

3 YOU ARE INCORRECT!

Refer to the text and return to BLOCK 11.

4 YOU ARE CORRECT!

The reverse operating limit is

a. BV — *GO TO BLOCK 11*

b. VR — *TO BLOCK 23*

5 YOU ARE INCORRECT!

Refer to the text and return to BLOCK 25.

6 YOU ARE CORRECT!

(Block 6, continued from preceding page)

I_R will _____ as T_A increases.

a. Decrease

GO TO BLOCK 12

b. Increase

GO TO BLOCK 22

7 *YOU ARE CORRECT!*

A diode is rated at 500 mw at 25° C and must be derated 3mw/° C. We wish to operate the diode at 125° C. What is $Pd_{t max}$ at 125° C?

a. $Pd_{t max}$ = _____

GO TO BLOCK 16

8 *You have completed the test for the second lesson. However, before going on you should review any area in this lesson you do not fully understand.*

10 *YOU ARE INCORRECT!*

Refer to the text and return to block 21.

11 *YOU ARE CORRECT!*

The forward voltage drop (V_F) is determined by

a. R_L

GO TO BLOCK 3

b. I_F

GO TO BLOCK 25

12 *YOU ARE INCORRECT!*

Refer to the text and return to BLOCK 6.

13 *YOU ARE INCORRECT!*

Refer to the text and return to BLOCK 22.

14 *YOU ARE CORRECT!*

V_F will _____ as the ambient temperature (T_A) increases.

a. Decrease

GO TO BLOCK 6

b. Increase

GO TO BLOCK 24

15 *YOU ARE INCORRECT!*

Refer to the text and return to BLOCK 1.

16 *200 mw. If you do not have this result your answer is incorrect. First check over your arithmetic.* Do not go on *until you obtain this correct answer.*

GO TO BLOCK 8

20 *YOU ARE CORRECT!*

The forward operating limit of a diode is

a. $Pd_{t max}$

GO TO BLOCK 21

b. B_V

GO TO BLOCK 2

21 *ARE CORRECT!*

The current which flows when a diode is reverse biased is

a. I_R

GO TO BLOCK 4

b. I_F

GO TO BLOCK 10

b 22 *YOU ARE CORRECT!*

As T_A increases, $Pd_{t max}$ _____.

a. Increases

GO TO BLOCK 13

b. Decreases

GO TO BLOCK 7

23 *YOU ARE INCORRECT!*

Refer to the text and return to BLOCK 4.

24 *YOU ARE INCORRECT!*

Refer to the text and return to BLOCK 14.

25 *YOU ARE CORRECT!*

The reverse current (I_R) is determined by

a. V_R

GO TO BLOCK 14

b. R_L

GO TO BLOCK 5

Lesson Three:

Switching

This lesson is concerned with switching, which is the basic operation of digital circuits. A transistor model is developed to describe graphically the internal operations of the transistor switch.

Transistor model:

Rather than enter into a lengthy discourse on semiconductor physics to describe the operational characteristics of transistors, we will in this lesson develop a model from lessons one and two. [Lesson one appeared in the March 15, 1981 issue of PLAY METER.] The model will behave like a transistor but will be made up of imaginary devices.

As shown in *figure 3-1,* there is a diode between the emitter and the base leads. This diode is referred to as the *base-emitter diode* and has the identical characteristics of the diode in lesson two. Between the emitter and collector leads is a current generator which produces a current [*beta* x I_B], where *beta* and I_B hold the same meaning as in lesson one.

Referring back to lesson one, formula *4* states:

$$\beta = \frac{I_C}{I_B}$$

solving for I_C, we have:

$$I_C = \beta \times I_B$$

Therefore, the current produced by the generator is the collector current, I_C. The dotted line connecting the diode and generator indicates that the generator is controlled by the diode. Since a transistor is basically a resistive device (the term *transistor* derives from *transfer resistor*), it is represented as a resistor, collector to emitter R_{CE}. The value of resistance is determined by the Ohm's Law value of the voltage, collector to emitter and I_C.

[8] $$R_{CE} = \frac{V_{CE}}{I_C}$$

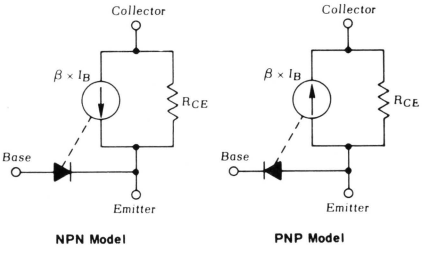


Fig. 3-1. Operational models for both a NPN and a PNP transistor. The current generator produces a current β x I_B when the diode is forward biased.

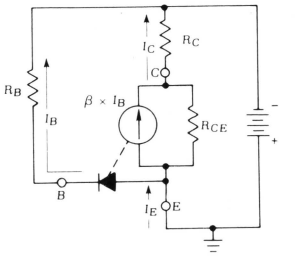


Fig. 3-2. An operational model of a PNP transistor connected into a circuit. Compare this circuit to the one in Fig. 1-5. The model replaces the PNP symbol.

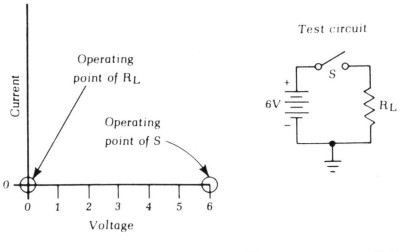


Fig. 3-3A. The operational characteristics of an open switch.

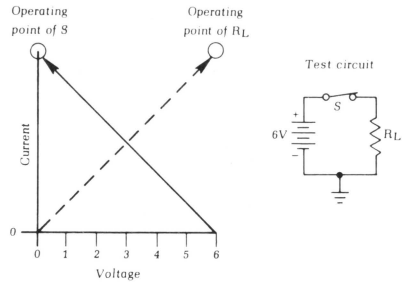


Fig. 3-3B. The operational characteristics of a closed switch.

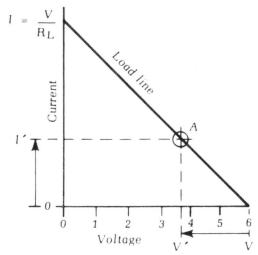


Fig. 3-3C. The dynamic characteristics of a switched circuit. The load line represents the transfer of voltage from the source to the load.

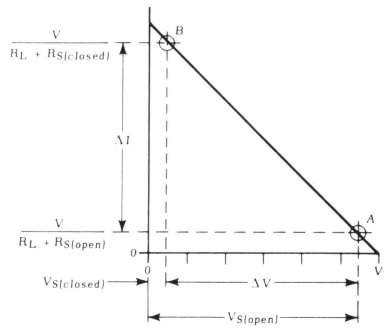


Fig. 3-4. The operational characteristics of a less-than-ideal switch. The voltage transferred to the load is less than that available at the source.

The model oprerate as follows:

When the diode is forward biased, a current will flow, I_B in *figure 3-2.* The quantity of I_B is determined by the resistance value of R_B and Ohm's Law. The voltage dropped across the diode is termed V_{BE} or *voltage base to emitter.* The characteristics of V_{BE} are identical to those of V_F in lesson two. When a current flows in the base circuit, a corresponding current will flow in the collector circuit. The collector current will be *beta* times larger than the base current [I_C = *beta* x I_B]. The voltage drops across R_C is the Ohm's Law value of R_C and I_C.

The Ideal Switch

As was the case with the diode in lesson two, we will first discuss an ideal switch before explaining a transistor switch. The purpose of a switch is to transfer a voltage from a source to a load. The circuit in *figure 3-3A* and the diagram of its operating point indicates that the open circuit characteristics of *S* are such that the entire battery voltage (6V) is present across the open contacts of the switch and that there is zero volt across R_L, and there is no current flow.

Figure *3-3B* shows the transitions which occur to the operating points when the switch is closed. The voltage across the switch contacts falls to zero while the voltage drop across R_L increases to the battery voltage. Also, the current through the circuit has risen to the Ohm's Law value of the battery voltage and R_L. Thus far, the characteristics of an open and closed switch have been described.

The dynamic characteristics of the switch as it closes are shown in *figure 3-3C.* As the voltage across the switch starts falling to zero, the voltage across R_L begins to rise. The voltage across R_L is the difference between the voltage across the switch contacts and the battery voltage. If we could stop the transition at V′ across the switch contacts, we would find the current had risen to a value less than maximum. If the voltage and current scales are projected, they would intercept at point A on *figure 3-3C.* If all the intercepts of the current and voltage values were plotted, a line would be drawn between the battery voltage and the static current (I). This line is commonly referred to as the *load line.*

A Less-than-ideal switch

The switch described above was assumed to have an infinite resistance when open and zero ohms when closed; hence, the zero voltage drop. Electromechanical devices, such as relays and switches, can—for practical purposes—be called ideal. However, as we shall soon see in the case of resistors, this is not so. The following paragraph will deal directly with a less-than-ideal switch in general before discussing a transistor switch.

The switch whose characteristics are shown in *figure 3-4* is less than ideal in the sense that when open, its resistance is such that enough current will flow to cause a voltage drop across R_L (*remember:* $V_{RL} = V_{BATT} - V_{SWITCH}$) and when closed, the voltage across the contacts is greater than zero.

The condition of not enough resistance when open and too much resistance when closed limits the change in voltage [delta V] and current [delta I] to less than the ideal. Note in *figure 3-4* that the voltage across the switch never reaches 6V and the current through the contacts does not increase to the maximum permitted by R_L.

The Transistor Switch

We have made no mention above as to how the switches were activated and de-activated. Switches are familiar devices, and they are usually operated by an external force applied to a shaft or lever (rotary or toggle switches). The transistor switch is activated by the base current. Because base current will flow only when the base-emitter diode is forward biased, it can then be stated that the *transistor switch is controlled by the base-emitter diode.*

The circuit in *figure 3-5* is a basic switching circuit and operates as did the model of the first paragraph in this lesson. The switch (S) from base to ground is a representation of a switching device, which in reality may be another transistor. When *S* is open, the base-emitter diode is forward biased and base current flows. This operating condition is represented at point *A* on the curves of *figure 3-6A* and *3-6B.* The vertical section f the base current in *figure 3-6A* is termed the *saturation region.*

Figure 3-6B is an expanded curve of the saturation region of *figure 3-6A.* It should be noted that while in the saturation region the transistor has a small voltage drop collector to emitter, therefore exhibiting a characteristic of the less-than-ideal switch. This voltage drop is termed $V_{CE}[sat]$ on the manufacturers' data sheets.

What is R_{CE} at the operating point A on fig. 3-6B?

$R_{CE} = \frac{V_{CE}}{I_C} = \frac{1.8V}{38ma} = 47.5\Omega$

When *S* is closed, the base is shorted to the ground, as is the emitter, removing the emitter base diode from the forward biased state. The transistor is, with *S* closed, operating at point

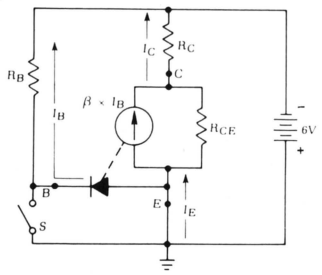


Fig. 3-5. An operational model of a PNP with a switch (S) connected from base to ground. In actual circuits the switch may be another transistor.

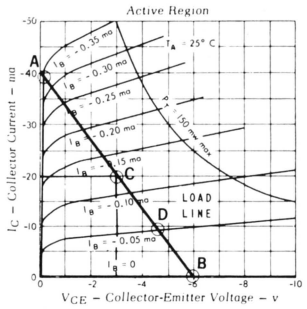


Fig. 3-6A. The operational characteristics of a transistor switch. Note the less-than-ideal characteristics at A and B.

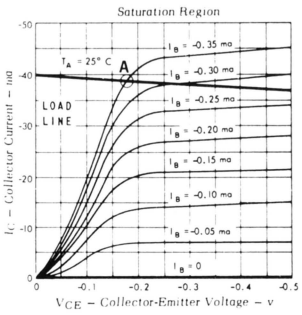


Fig. 3-6B. The operational characteristics of the saturation region. Point A is the same as point A in Fig. 3-6A.

B on curve *3-6A*. The portion of the curves below the curve $I_B = 0$ is termed the *cutoff region*. Note that when operated at the cutoff region, a small current still flows in the collector current. Again the resistor switch exhibits less-than-ideal characteristics.

Should the transition from the saturation region to the cutoff region (or vice versa) be halted, say at point C on *figure 3-6A*, the transistor would be operating in the *active region*. In this case the voltage across the transistor V_{CE} would be -3V also, the collector current I_C would be -20ma.

Any point on the load line between points A and B is in the active region. The active region is of little, if any concern to the digital circuit designer since it belongs in the realm of linear circuits. Because digital circuits operate in either the saturation or cutoff regions, points A and B are of primary concern.

When a transistor is operated in the saturation region, it is said to be *saturated* or *on;* and when operated in the cutoff region, it is said to be *cutoff* or *off.* ■

What is V_{CE}, the voltage across R_C and I_C at point D on fig. 3-6A?

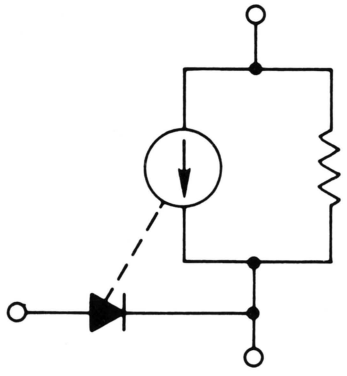
V_{CE} = -4.7V, I_C = -8ma and V_{RC} = -1.3V

End of Lesson Three

PROGRAMMED TEST, LESSON THREE

Again, start at block one and follow the numbered instruction associated with your answer

1



The model shown in the figure is that of a/an

_____ *transistor.*

a. *PNP* — *GO TO BLOCK 12*
b. *NPN* — *GO TO BLOCK 20*

2 YOU ARE INCORRECT!

Refer to the text and return to BLOCK 20

3 YOU ARE CORRECT!

The current $\beta \times I_B$ is the

_____

a. *Base current*
GO TO BLOCK 14
b. *Collector current*
GO TO BLOCK 25

4 YOU ARE CORRECT!

When all of the power supply voltage is across the transistor, the transistor is operating in the _____

a. *Saturation region*
GO TO BLOCK 10
b. *Cutoff region*
GO TO BLOCK 22

5 YOU ARE INCORRECT!

Refer to the text and return to BLOCK 22.

6 YOU ARE INCORRECT!

Refer to the text and return to BLOCK 15.

7 YOU ARE CORRECT!

When operating in the saturation region, there is a small voltage drop across the transistor. This voltage is termed

_____

a. $V_{CE(sat)}$
GO TO BLOCK 17
b. V_{BE}
GO TO BLOCK 24

8 YOU ARE CORRECT and have completed the test for the third lesson. However, you should review the concepts of this lesson. Future lessons will assume you understand this subject matter.

10 YOU ARE INCORRECT!

Refer to the text and return to BLOCK 4

11 YOU ARE INCORRECT!

Refer to the text and return to BLOCK 25

12 YOU ARE INCORRECT!

Refer to the text and return to BLOCK 1.

13 YOU ARE CORRECT!

The current generator produces a current

$$\beta \times I_B$$

when the base-emitter diode is _____

a. *Forward biased*
GO TO BLOCK 3
b. *Reverse biased*
GO TO BLOCK 21

14 YOU ARE INCORRECT!

Refer to the text and return to BLOCK 3.

15 YOU ARE CORRECT!

*When the transistor is operating in the saturation region, I_C is determined by*___

a. *beta times I_B*
GO TO BLOCK 6
b. *V_{CC} and R_C*
GO TO BLOCK 23

16 YOU ARE INCORRECT!

Refer to the text and return to BLOCK 23.

17 YOU ARE CORRECT!

Digital circuits operate between the ___ *region and the*_____*region.*

a. *Saturation/cutoff*
GO TO BLOCK 8
b. *Active/cutoff*
GO TO BLOCK 19

19 YOU ARE INCORRECT!

Refer to the text and return to BLOCK 17.

20 YOU ARE CORRECT!

The current generator in the model is controlled by _____

a. The base-emitter diode
GO TO BLOCK 13

b. Beta
GO TO BLOCK 2

21 YOU ARE INCORRECT!

Refer to the text and return to BLOCK 13.

22 YOU ARE CORRECT!

When all of the power supply voltage is across the load (R_C), the transistor is operating in the _____

a. Saturation region
GO TO BLOCK 15

b. Cutoff region
GO TO BLOCK 5

23 YOU ARE CORRECT!

When operating in the saturation region, R_{CE} is _____

a. Very high
GO TO BLOCK 16

b. Very low
GO TO BLOCK 7

24 YOU ARE INCORRECT!

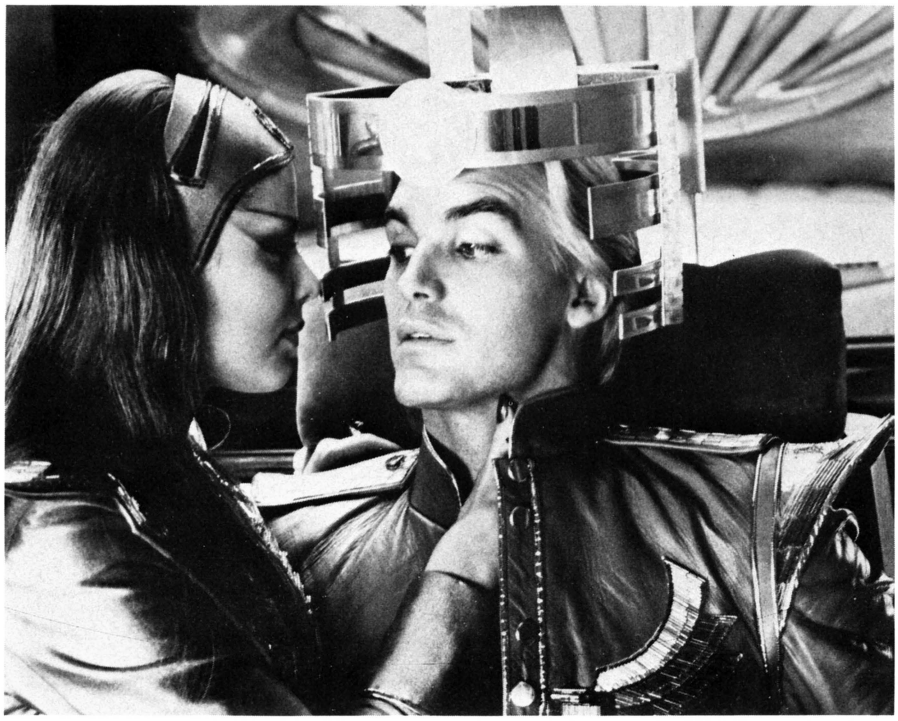
Refer to the text and return to BLOCK 7.

25 YOU ARE CORRECT!
The transistor switch is activated by _____.

a. The base-emitter diode
GO TO BLOCK 4

b. Collector current
GO TO BLOCK 11

The Kurz Kasch courses will continue in subsequent issues of PLAY METER and the Update edition. Included in the April 15 issue will be a breadboard project.



'You say you have pinball games on your planet, but you need my quarters?' Kidding aside, this pair are from the film 'Flash Gordon'—that's him under the atomic hair-dryer, and she's the pretty, plotting Princess Aura, who's blow-drying his mind. They'll also appear in living color on a Bally pingame backglass (see the expanded New Products section inside this Update). The Flash Gordon *pinball debuted recently on the NBC Today Show with actor Max Von Sydow (Ming the Merciless) showing his pinball skills. Bally has also entered into a co-promotion with Universal Studios to boost the opening of the film at theaters which will have the* Flash Gordon *machine on display in lobbies. (Photo ©1980 by Universal City Studios)*

Court moves for Stern video

CHICAGO—Stern Electronics, Inc. has been granted a preliminary injunction against Omni Video Games, Inc. and Ferncrest Distributors, Inc., both of Warwick, Rhode Island, in connection with an alleged infringement by Omni and Ferncrest of Stern's copyright on its *Astro Invaders* video game.

Stern filed suit in federal court in Brooklyn, New York, claiming that the *Zygon* video game sold by Omni and Ferncrest infringed the copyright on *Astro Invaders* and that Stern is the exclusive licensee under that copyright.

At the same hearing before U.S. District Judge Eugene Nickerson, Stern representatives presented a video tape of the *Astro Invaders* game and compared it with a video tape of Omni and Ferncrest's *Zygon* game. Stern counsel advised the court that the copyright covered the *Astro Invaders* audio-visual components, particularly the presentation of the figures on the video screen.

The court on December 19 enjoined Omni and Ferncrest from marketing *Zygon* games while the lawsuit is pending, and ordered all *Zygon* games in their possession or control be impounded during the pendency of the lawsuit.

New door protection

Coin Controls Ltd. of England announced modifications to its *S10* frontplate and door assemblies which will be incorporated into production from January 1st 1981 and which may be purchased as sets of parts for site modification where warranted.

The new model allows for fast feeding (particularly for token refill) without jamming and simultaneously foils the latest break-ins being tried on these units, according to Coin Controls. In adding these new features to the new 50 pence "bounce anvil" (incorporated as standard over two months ago), Coin Controls stated that they are defeating any attempts at repeated fraud being reported on UK machines.

R&N changes name but not its stripes

SAN JOSE — Brian Warkentin, marketing vice president of R&N Silkscreening, Inc., has announced that the firm has changed its name to Willis Industries, Inc.

He explained that the firm "needed a name more suitable to the services it offers." Willis Industries produces graphics for a number of the major coin-op games manufacturers, including Exidy, Gremlin, Centuri, Sircoma, and others.

The company offers a complete graphic design service, as well as the screenprinting. It has developed many of the innovative concepts used in video game graphics such as polycarbonate control panels and pressure sensitive side decals.

'Panic' sets out

Universal U.S.A. has debuted its newest video strategy game, *Space Panic*, available in upright and table versions.

The object of the game is for the player to position his man by climbing ladders to different levels and trap the attacking monsters on the screen by digging and closing holes. Point values are awarded to the number of floors that the monster drops.

Space Panic is a totally progressive game in which the attackers vary in number and shape and distance they must fall to be destroyed.

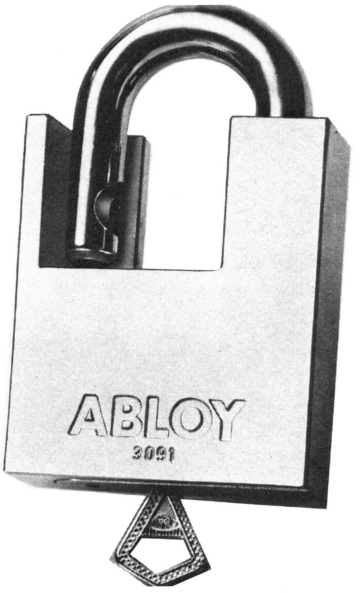
Space Panic is a fast paced game that has been testing extremely well, and Universal sampled its distributors for early February delivery, said the manufacturer.

More change

Standard Change-Makers, Inc. of Indianapolis, has introduced a new hopper-load changer that changes both $1 and $5 bills and holds up to 10,000 quarters ($2,500) in change.

Designed specifically for amusement centers, coin laundries, and vending locations with high-volume traffic or where owners desire less frequent filling, this new super-capacity changer normally vends four quarters for $1 or 20 quarters for $5, but can also be set up to vend tokens of a similar size and weight as the quarter, said the manufacturer.

Series 8101, the new changer, features hopper-loading and has just one large hopper. It includes all the features of Standard Change-Makers' regular *Model 80* changer—a unique dispensing system which has no belts and motors, but moves coins through the machine by means of gentle magnetic vibration; cabinet with simple, straight-line design that blends with any decor; front and top-opening doors that maintain security, but offer easier access to all the internal, modular components; separate $1 and $5 verifiers with bill stackers that face and stack the $1 and $5 bills separately.



Shackled security

Abloy's No. 3091 shrouded shackle padlock represents the latest in high-security lock design, said the manufacturer, the entire case of the lock being made from investment cast stainless steel. Abloy's new padlock is impervious to moisture, dirt, freeze-up, chemical corrosion, and rust.

Abloy's cast stainless steel padlock features the original rotating disc cylinder for maximum security and wear life. Ordinary spring-loading locking pins can corrode, stick, or simply wear out under conditions of harsh natural or chemical environments. The shrouded steel shackle of No. 3091 is protected from the elements, as well as attempts to saw, drill, parrot cut, or acid burn for forced entry.

When a combination or keys need changing, or if the locking mechanism should become defective, the No. 3091 padlock provides a removable cylinder which is protected by a stainless steel, anti-drill coverplate. The user is able to change only the cylinder, representing a cost saving. A recessed, limited-access keyway further enhances security of this lock.

For more information, phone 312/647-9650; in Canada: 314/735-4343. Or write Abloy, 5603 W. Howard Street, Niles, Illinois 60648. Telex: 283 495.

Pingame from Planet Mongo

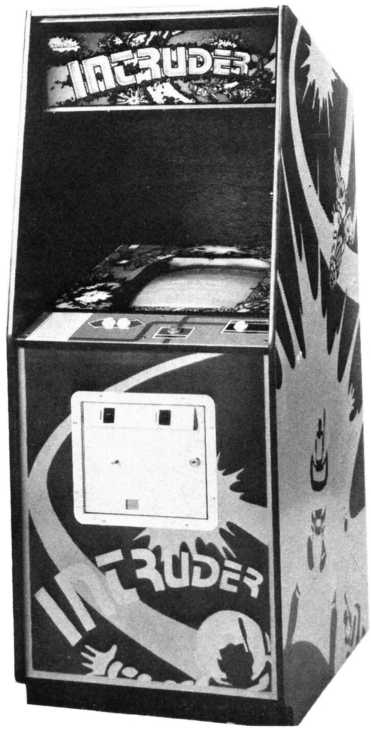
"Flash Gordon," the adventure-fantasy film has been licensed by Bally Pinball Division for a pinball machine. Players take on the character of Flash Gordon, savior of the earth in his struggle to defeat Ming the Merciless— who tries to destroy the earth. Three totally new pinball features appear on this game along with four bonuses to attract players for out-of-this-world earnings.

Bally's *Flash Gordon* introduces a unique two-level playfield. Players will be captivated by the fast-action pinball play these two levels provide, complete with three ramps and multi-directional kicker that kicks to either level. Each level contains two independent bonus systems.

The upper level, Ming's palace, is a game in itself, entered by the shooter lane which sets up a single drop target guard and lights the shooter lane to collect the bottom level bonus. Once in the upper level, players can shoot for drop targets with a flashing 1-2-3 arrow that qualifies the mini-bonus, a stationary target, and rollovers.

The lower level has a super bonus, activated by a bank of flashing drop targets on the lower left. Matching these flashing colors to the right targets and the flipper return lane rollovers lites the super bonus for 100,000 points. This level also contains the Wood Beast in-line drop targets to multiply bonus 2X or 3X, score points, and give extra balls. The bonuses can then also be multiplied 4X and 5X, by the upper and lower drop targets when the Wood Beast targets are completed.

Flash Gordon contains another pinball first: a 15-second feature. Entering the palace saucer starts the timer and players then have 15 seconds to multiply all playfield scores. Completing the mini-bonus sets the Palace Saucer to award 2X playfield scores. Completing the super bonus sets the saucer to award 3X playfield scores and if both are completed the saucer will award 5X all playfield scores.



'Intruder' appears

A new concept in space motif video games has been announced by Game Plan, Inc., Addison, Illinois manufacturer of coin-operated amusement games. Known as *Intruder*, the new laser base game is claimed to answer the demand for increased skill while being equally exciting for the casual player.

Ken Anderson, Game Plan director of marketing, said: "All of our preliminary tests indicate above average earnings can be expected from *Intruder*. We feel this is essential in today's highly competitive market.

"This new game features a unique combination of graphics, challenge, excitement and electronics which combine to answer all of the requirements of a successful game," he said.

Rather than the usual action of space vehicles attacking the player, *Intruder* features two space ships in combat with each other. The two mother ships are located at top and bottom of the screen, with numerous space vehicles passing between them. Points are scored both for hitting the mother ships and for hitting the smaller ships in between.

"But there's a catch," continued Anderson, "Each player has a limited fuel supply. If he expends too much fuel blasting the smaller ships, his laser will no longer reach the mother ship for the big score. Then he gets zapped!"

Futher information may be obtained from Game Plan, Inc., Marketing Department, 1515 West Fullerton Avenue, Addison, Illinois 60101; Phone: 312/628-8200.

classified advertising

OLD/ANTIQUE SLOT MACHINES WANTED: Call collect after 5 pm. **JACKPOT AMUSEMENTS,** 14216 Clark St., Riverdale, ILL 60627. 312/849-4041.

WANTED: Electronic mechanic—pinball games. Must be complete and clean. State price. Will pick-up in NY or FL area. Write or call: **RAINBOW LEISURE TIME,** 1811 Mears Parkway, Margate, FL 33063. 305/973-9364.

CHICAGO COIN PARTS—entire inventory of former ChiCoin distributor for sale. $2000.00 takes all. Call for details. Largest cache known to exist. Archeologists won't need 'em! 213/746-1191.

WANTED: Used coin counter. Either manual or electric. Write: **K & R ENTERPRISES,** Box 2476, Grand Rapids, MI 49501. c/o Wm. Remer.

SACRIFICE FOR CASH—18,000 sq. ft. OFFICE BUILDING AND GAME ROOM. Annual income potential $100,000. Sale priced $400,000. Ample parking. Phone: **THE MUSIC SHOP,** Mr. Pearson or Ms. Casey 919/527-5156.

FOR SALE: new Klopp, Johnson, Bilotta, electric or manual hand coin counters in stock. **PLAY MORE GAMES, INC.,** 1121 E. Seminary Dr., Ft. Worth, TX 76115. 800/433-2908 (US); 800/772-2703 (TX).

COCKTAIL TABLES FOR SALE: Asteroid, Space Firebird, Space Invader, Moon Cresta, Phoenix, Pac-Man. Call Alan or Sal at 201/926-0700.

FOR SALE: Williams' 1962 "3-Coins" pinball—antique. Excellent condition. Call 714/454-8252 or 442-2690.

WANTED: Slot machines, Sircoma Draw 80 Poker, used, or equivalency. Reply: **AAA VENDING,** P.O. Box 18505, Cleveland Heights, OH 44118.

WANTED: Williams' Stop-N-Go. Call or write: Rob Berk, 704 Perkinswood NE, Warren, OH 44483. 216/369-1192.

FRUSTRATED??? Need conscientious person, familiar with coin-op game repair, music. Progressive company, supervisory position. Begin in New Haven, CT area. 8-5, 5 days. Send resume: **BETSON ENTERPRISES,** #6 Empire Blvd., Moonachie, NJ 07074.

FOR SALE: Atari Sprint I $625; Kee Jet Fighter $230; SAMI $175; Video monitor repairs, Motorola, Wells-Garner. WE also stock electronic parts, ICs, Transistors at discount prices. Write or Call: **G & G AMUSEMENT REPAIR,** 253 Maple St., New Britain, CT 06051. 203/229-9708.

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CPU Boards, Monitors (Conventional & XY), Power Supplies, Audio Boards, etc. Call or Write:
CHALLANGER ELECTRONICS — 8621 49th St. N., Pinellas Park, FL 33565. 813/546-4426.

USED SPACE INVADER COCKTAIL TABLES: $695.00 each. F.O.B. New Jersey. **UNIVERSE AFFILIATED INTERNATIONAL, INC.** 201/245-4222.

VIDEO GAMES—COCKTAIL TABLES. Coin-operated under $300.00. Call for prices: **SKYLAND AMUSEMENTS** 609/662-6622 (NJ) or 404/636-4263. (GA).

WANTED: Seeburg Home Entertainment Center. FREE PLAY 33 1/3 rpm; L.P. jukebox; w/10 key keyboard. Call 701/662-4321.

BOOM BALL—Lost our lease. 15 Boom Balls available. Will sell 5/10/15 (reasonable). Call 313/792-1850.

MECHANICAL BULL for sale $5,500.00. Foam rubber, mattress pads, and corral for enclosing bull included. Write or call: 100 Lealand Dr., Clarksville, TN 37040. 615/647-2130.

FOR SALE: Penny Falls (complete)—$1000.00 as is. Wild Gunman (w/extra parts)—$500.00 as is. Namco F-1 Race Game—$500.00 as is. Call 405/626-3908.

FOR SALE: red & blue foosball men 50¢ each or 35¢ each in lots of 100. **BISMARCK AMUSEMENT COMPANY**, 1819 Michigan Ave., Bismarck, ND 58501. 701/255-0477.

100,000 used 45 rpm records. 18 years old to present. Counted, crated, and ready for pick-up at North Bend, NE. Make offer. **KORT AMUSEMENT,** North Bend, NE 68649. 402/652-8187.

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SEEBURG MUSIC PARTS, GLASS, ETC.—some for older models, some for newer models. Call or write today. **B.C. SALES**, 70 East Main Street, Avon, MA 02322. 617/588-1369.

SLOT MACHINES REPAIR & RESTORATION. Also buying parts and machines. **J. WEBER**, 434 Nold Ave., Wooster, OH 44691. 216/264-6897.

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